Association of Cognitive Impairment With Treatment and Outcomes in Older Myocardial Infarction Patients: A Report From the NCDR Chest Pain–MI Registry

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Background—Little is known regarding use of cardiac therapies and clinical outcomes among older myocardial infarction (MI) patients with cognitive impairment.

Methods and Results—Patients ≥65 years old with MI in the NCDR (National Cardiovascular Data Registry) Chest Pain–MI Registry between January 2015 and December 2016 were categorized by presence and degree of chart-documented cognitive impairment. We evaluated whether cognitive impairment was associated with all-cause in-hospital mortality after adjusting for known prognosticators. Among 43 812 ST-segment–elevation myocardial infarction (STEMI) patients, 3.9% had mild and 2.0% had moderate/severe cognitive impairment; among 90 904 non–ST-segment–elevation myocardial infarction (NSTEMI patients, 5.7% had mild and 2.6% had moderate/severe cognitive impairment. A statistically significant but numerically small difference in the use of primary percutaneous coronary intervention was observed between patients with STEMI with and without cognitive impairment (none, 92.1% versus mild, 92.8% versus moderate/severe, 90.4%; *P*=0.03); use of fibrinolysis was lower among patients with cognitive impairment (none, 40.9% versus mild, 27.4% versus moderate/severe, 24.2%; *P*<0.001). Compared with NSTEMI patients without cognitive impairment, rates of angiography, percutaneous coronary intervention, and coronary artery bypass grafting were significantly lower among patients with NSTEMI with mild (41%, 45%, and 70% lower, respectively) and moderate/severe cognitive impairment (71%, 74%, and 93% lower, respectively). After adjustment, compared with no cognitive impairment, presence of moderate/severe (STEMI: odds ratio, 2.2, 95% CI, 1.8–2.7; NSTEMI: odds ratio, 1.7, 95% CI, 1.4–2.0) and mild cognitive impairment (STEMI: OR, 1.3, 95% CI, 1.1–1.5; NSTEMI: odds ratio, 1.3, 95% CI, 1.2–1.5) was associated with higher in-hospital mortality.

Conclusions—Patients with NSTEMI with cognitive impairment are substantially less likely to receive invasive cardiac care, while patients with STEMI with cognitive impairment receive similar primary percutaneous coronary intervention but less fibrinolysis. Presence and degree of cognitive impairment was independently associated with increased in-hospital mortality. Approaching clinical decision making for older patients with MI with cognitive impairment requires further study. (***J Am Heart Assoc***. 2019;8: e012929. DOI: 10.1161/JAHA.119.012929.)

Key Words: cognitive impairment • myocardial infarction • percutaneous coronary intervention • health services research

Older adults comprise a substantial and growing proportion of acute myocardial infarction (MI) patients.[1] One fifth of older adults have impairment of cognitive function,[2] with higher prevalence among those with vascular disease.[3]

Cognitive impairment is an important source of functional decline and increased healthcare utilization.[4] Prior studies have shown worse outcomes in patients with MI with dementia as compared with not having dementia.[5]

Clinical Perspective

What Is New?

- Approximately 1 in 13 older patients with myocardial infarction in the United States have cognitive impairment documented in medical charts; patients with non–ST-segment–elevation myocardial infarction with cognitive impairment are substantially less likely to receive invasive cardiac care, while patients with ST-segment–elevation myocardial infarction with cognitive impairment receive similar primary percutaneous coronary intervention but less fibrinolysis.
- Presence and degree of cognitive impairment was independently associated with increased in-hospital mortality.

What Are the Clinical Implications?

- Improving outcomes of this patient population requires understanding the myocardial infarction presentation in the context of other medical conditions and patient goals of care.
- Additional studies are needed to determine an optimal approach to inform clinical decision making for older patients with myocardial infarction with cognitive impairment.

Mechanisms for worse outcomes are multifactorial and include delayed recognition of the symptoms and contact with medical care, therapeutic nihilism toward invasive procedures, and risk of delirium with therapeutic intervention and polypharmacy. Cognitive impairment without dementia is more prevalent and includes a spectrum of age-related cognitive decline to mild cognitive impairment. Gharacholou et al[6] showed that after MI, even mild cognitive impairment was associated with less invasive care, and less referral and participation in cardiac rehabilitation, with moderate to severe cognitive impairment associated with worse risk-adjusted 1-year survival. The NCDR (National Cardiovascular Data Registry) Chest Pain–MI Registry provides a unique opportunity to evaluate the relationship between cognitive impairment as abstracted from the medical chart and received care and outcomes in a contemporary US cohort of patients with MI. In this study, we specifically sought to report the prevalence of cognitive impairment among older patients with MI and explore the association of the presence and degree of cognitive impairment with use of evidence-based cardiac therapies and in-hospital mortality after MI.

Methods

The data, analytic methods, and study materials will not be made available to other researchers for purposes of reproducing the results or replicating the procedure.

Data Source and Analysis Population

All patients enrolled with ST-segment–elevation myocardial infarction (STEMI) and non–ST-segment–elevation myocardial infarction (NSTEMI) in the NCDR Chest Pain–MI Registry from January 1, 2015, to December 31, 2016, were included in the initial study population (n=293 197 from 781 hospitals). The NCDR Chest Pain–MI Registry, formerly known as NCDR Acute Coronary Treatment and Intervention Outcomes Network Registry—GWTG (ACTION Registry—Get With the Guidelines), serves as a hospital data collection and evaluation mechanism for patients with MI in the US and has been described previously.[7] All participating hospitals were required to comply with local regulatory and privacy guidelines and, if required, to secure institutional review board approval. Because data were used primarily at the local site for quality improvement, sites were granted a waiver of informed consent under the common rule. The Duke Clinical Research Institute served as the data analysis center and has an agreement to analyze the aggregate deidentified data for research purposes. For this analysis, patients <65 years of age (n=148 843), and patients with missing information (n=415), or unknown status for the cognition variable (n=9223) were excluded. The final study population consisted of 134 716 patients.

Cognition Variable

Baseline cognitive function was added as a data field to the NCDR Chest Pain-MI Registry case report in March 2014 (version 2.4). Data abstractors scored cognition on 3 levels of neuropsychiatric functioning: normal, mildly impaired, or moderate to severely impaired. Mildly impaired cognitive function includes mild dementia, not limiting simple exchanges, and mild depression. Such mild impairments may be identified only by family or may be a comorbid diagnosis treated with medications yet requiring minimal support. Short-term memory loss is often present from the beginning of this spectrum. Moderate or severely impaired cognitive function includes notable short-term memory loss, disorientation, and/or confusion, which limit the ability to participate in simple exchanges. Moderate to severe cognitive impairment may also result from severe depression, which has many of the same manifestations and consequences.

Statistical Analysis

Descriptive statistics were summarized as medians with 25th and 75th percentiles for continuous variables and as percentages for categorical variables. Differences between groups were compared by use of Kruskal–Wallis test for continuous variables and Pearson's chi-squared test for

categorical variables. Baseline cognitive function was stratified into the 3 abstracted groups based on the presence and degree of cognitive impairment (no cognitive impairment, mild cognitive impairment, and moderate/severe cognitive impairment) separately for STEMI and NSTEMI cohorts. Baseline demographics, presentation characteristics, in-hospital treatments, and outcomes were compared among the 3 groups. In particular, the frequency and timeliness of reperfusion therapy (thrombolysis and primary percutaneous coronary intervention [PCI]) was determined among patients with STEMI, and the frequency of medical therapies (aspirin, $P2Y_{12}$ receptor inhibitor, statin, beta-blocker, angiotensin-converting enzyme inhibitor/angiotensin receptor blocker) administered within 24 hours of presentation and at hospital discharge, as well as frequency of in-hospital cardiac catheterization and revascularization (PCI and coronary artery bypass grafting [CABG]) were determined among both STEMI and NSTEMI patients.

For the in-hospital all-cause mortality, we further excluded patients transferred out (n=7041). Thus, for this analysis, the sample consisted of 127 675 patients. To investigate the association between in-hospital mortality and cognition status separately by MI type, logistic generalized estimating equation regression with an exchangeable working correlation matrix to account for within-hospital clustering of outcome was used to model the probability of in-hospital mortality.[8] Adjusted odds ratios (ORs) with 95% CIs were calculated for mildly impaired and moderately/severely impaired cognition with normal functioning as the reference. Covariates for these models included variables from the published and validated mortality model[9] as well as additional covariates. The full list of covariates includes demographics (age, sex, race, weight), medical history (hypertension, diabetes mellitus, current/recent smoking, dyslipidemia, prior MI, prior PCI, prior CABG, prior heart failure, prior stroke, prior peripheral arterial disease, prior atrial fibrillation/flutter, cancer), characteristics on presentation (heart failure, heart rate, systolic blood pressure, cardiac arrest, cardiogenic shock), laboratory results (initial hemoglobin, creatinine clearance, troponin ratio), medications prior to admission (aspirin, clopidogrel, warfarin, beta-blocker, angiotensin-converting enzyme inhibitor, angiotensin receptor blocker, aldosterone antagonist, statin, nonstatin lipid-lowering). A value of $P<0.05$ was considered significant for all tests. All statistical analyses were performed in SAS software version 9.4 (SAS Institute, Cary, NC).

Results

Patients With STEMI

Among 43 812 patients with STEMI with documented cognitive status, cognitive impairment was present in 5.9% (3.9%

mild cognitive impairment and 2.0% moderate/severe cognitive impairment). Compared with patients with STEMI with normal cognition, patients with STEMI with cognitive impairment were older, of lower body weight, and had more comorbidities, including hypertension, diabetes mellitus, atrial fibrillation/flutter, prior stroke, and peripheral arterial disease (Table 1). Patients with cognitive impairment also had substantially greater impairment in mobility and greater requirement for assistance with activities of daily living. Heart failure and cardiogenic shock on presentation were greater among patients with STEMI with cognitive impairment. Compared with patients with normal cognitive function, ambulance transport use was 38.8% greater and use of prehospital ECG was 17.6% greater among patients with cognitive impairment (Table 1). Although the duration of symptom onset to first medical contact (FMC) was shorter among patients with cognitive impairment, a significantly lower proportion of patients with cognitive impairment underwent ECG within 10 minutes of emergency department arrival.

Patients with cognitive impairment were less frequently treated with cardiac medical therapies including aspirin or a $P2Y_{12}$ receptor inhibitor within 24 hours or parenteral anticoagulation in-hospital compared with patients without cognitive impairment (Table 2). There was only marginal numeric difference in rate of primary PCI by cognitive status (no cognitive impairment, 92.1% versus mild cognitive impairment, 92.8% versus moderate/severe cognitive impairment, 90.4%; $P=0.03$). Excluding primary PCI-treated and thrombolytic-ineligible patients, use of thrombolytic therapy was lower among patients with cognitive impairment (no cognitive impairment, 40.9% versus mild cognitive impairment, 27.4% versus moderate/severe cognitive impairment, 24.2%; $P<0.001$). Duration from FMC to device was slightly longer among patients with cognitive impairment, and use of CABG was significantly lower among patients with cognitive impairment. At discharge, there was no difference in use of aspirin or beta-blocker; however, use of $P2Y_{12}$ receptor inhibitors, angiotensin-converting enzyme inhibitor/angiotensin receptor blocker and statin was lower among patients with cognitive impairment.

Clinical outcomes

Compared with patients with normal cognitive function, patients with mild cognitive impairment had roughly 2.5-fold and patients with moderate/severe cognitive impairment had about 4-fold higher in-hospital mortality (Figure). After risk adjustment, cognitive impairment remained significantly associated with higher in-hospital mortality (mild: OR, 1.3, 95% CI, 1.1–1.5; moderate/severe: OR, 2.2, 95% CI, 1.8–2.7). Among patients discharged alive, 85.6% of patients with normal cognitive function were referred for cardiac rehabilitation, while 79.4% of patients with STEMI with mild cognitive

Table 1. Baseline Demographics and Presentation Characteristics by Presence and Degree of Cognitive Impairment Among Patients With STEMI and NSTEMI

Variable	STEMI				NSTEMI			
	No Cognitive Impairment (n=41 206)	Mild Cognitive Impairment (n=1709)	Moderate/Severe Cognitive Impairment (n=897)	Unknown (n=3283)	No Cognitive Impairment (n=83 395)	Mild Cognitive Impairment (n=5180)	Moderate/Severe Cognitive Impairment (n=2329)	Unknown (n=5940)
Demographics								
Age, y	72 (68–79)	82 (74–87)	84 (77–88)	75 (69–82)	74 (69–81)	82 (75–88)	84 (78–89)	77 (71–84)
Sex, male	63.8	44.2	42.3	55.9	59.6	46.9	45.3	55.2
Weight, kg	81.1 (69.5–93.2)	72.5 (60.9–84.8)	68.5 (59.0–81.6)	78.0 (65.8–90.7)	81.6 (69.3–95.0)	73.0 (61.6–85.7)	71.0 (59.7–82.0)	78.0 (66.0–91.2)
Medical history								
Current/recent smoker	20.9	12.0	6.9	18.2	15.2	9.8	6.7	14.9
Hypertension	73.7	80.9	78.7	75.4	85.1	88.4	85.9	86.7
Dyslipidemia	58.9	63.1	54.2	54.2	71.4	69.6	61.6	67.9
Dialysis	1.0	2.5	1.7	2.2	3.0	4.0	2.9	5.1
Cancer	13.2	17.7	14.3	14.3	16.4	19.7	17.4	16.7
Diabetes mellitus	29.1	34.9	33.7	31.7	41.4	42.7	39.0	44.8
Prior myocardial infarction	17.0	20.8	15.7	16.9	26.7	27.9	22.8	27.0
Prior heart failure	6.3	14.4	15.7	10.4	18.3	31.2	32.9	25.7
Prior PCI	20.2	20.1	15.7	19.9	29.4	25.5	18.3	29.1
Prior CABG	8.3	10.0	8.3	10.0	20.5	20.4	17.3	22.4
Prior atrial fibrillation/flutter	9.4	16.6	20.0	12.4	16.1	24.4	24.4	19.7
Prior stroke	5.9	18.7	21.5	10.6	9.5	22.0	24.2	15.4
Peripheral arterial disease	6.5	10.5	9.5	8.8	12.3	13.7	13.2	15.1
Home functioning								
Walking, unassisted	91.8	41.4	19.6	7.5	86.3	36.5	18.3	8.3
Independent of all ADLs	94.5	38.5	10.7	5.7	91.2	39.5	11.9	6.9
Presentation characteristics								
Prehospital ECG	43.7	51.0	52.1	45.7	24.6	29.8	34.0	25.8
Ambulance transport to first facility	52.8	71.7	79.0	65.5	NA	NA	NA	NA
Heart rate, bpm	77 (64–91)	80 (65–98)	81 (65–100)	79 (62–97)	83 (70–98)	87.5 (73–102)	86 (73–102)	85 (72–102)
Systolic blood pressure, mm Hg	142 (120–165)	133 (110–158)	125 (99–150)	132 (102–157)	151 (131–174)	142 (121–165)	138 (116–159)	146 (124–170)
Heart failure	7.9	16.7	21.4	13.7	17.9	29.2	31.8	25.3
Cardiogenic shock	7.3	11.5	17.5	21.9	1.4	2.4	3.0	4.2
Cardiac arrest	6.0	6.1	9.0	20.1	1.3	1.6	2.2	4.5
Symptom onset to first medical contact, h	1.3 (0.6–3.2)	1.2 (0.5–3.3)	0.9 (0.4–2.8)	1.1 (0.5–3.0)	2.2 (1.0–5.5)	2.0 (0.8–5.2)	1.5 (0.6–4.3)	2.2 (0.9–5.3)
Comfort measures directive	3.7	14.2	31.9	14.8	2.7	11.0	25.2	8.6

Continuous variables are expressed as median (25th, 75th percentile), and categorical variables are expressed as percentages. ADLs indicates activities of daily living; CABG, coronary artery bypass grafting; NA, not applicable; NSTEMI, non–ST-segment–elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST-segment–elevation myocardial infarction.

Table 2. In-Hospital Management and Outcomes by Presence and Degree of Cognitive Impairment Among Patients With STEMI and NSTEMI

	STEMI				NSTEMI			
	No Cognitive Impairment (n=41 206)	Mild Cognitive Impairment (n=1709)	Moderate/Severe Cognitive Impairment (n=897)	Unknown (n=3283)	No Cognitive Impairment (n=83 395)	Mild Cognitive Impairment (n=5180)	Moderate/Severe Cognitive Impairment (n=2329)	Unknown (n=5940)
Medications within 24 h								
Aspirin	98.4	96.7	95.5	93.4	97.6	95.6	94.1	95.5
P2Y$_{12}$ receptor inhibitor	89.2	81.3	70.7	77.1	50.1	39.6	31.0	45.8
Beta-blocker	81.6	76.7	67.3	62.6	81.1	78.1	73.3	75.3
ACE inhibitor/ARB	44.7	36.8	25.6	30.5	40.4	35.5	30.5	35.1
Statin	76.4	68.4	58.1	57.7	67.8	63.0	53.7	60.6
Any anticoagulant during hospitalization	96.8	93.4	90.0	93.3	93.0	86.0	81.8	90.1
Reperfusion/revascularization								
ECG within 10 min of ED arrival*	76.1	57.1	53.0	70.0	63.1	45.3	39.1	57.1
Cardiac catheterization	…	…	…	…	84.7	50.3	24.6	71.6
Overall reperfusion	95.4	93.6	90.6	93.5	NA	NA	NA	NA
Fibrinolysis†	40.9	27.4	24.2	29.1	NA	NA	NA	NA
Primary PCI	92.1	92.8	90.4	90.5	NA	NA	NA	NA
PCI	…	…	…	…	49.4	27.3	12.7	41.4
CABG	5.3	2.3	0.7	3.3	10.9	3.3	0.8	7.9
Overall revascularization	…	…	…	…	59.7	30.5	13.5	48.7
First medical contact to device time, min	78 (64, 97)	81 (66, 102.5)	83 (70, 107)	82 (67, 103)	NA	NA	NA	NA
Medications/interventions at discharge								
Aspirin	98.3	96.2	92.3	96.9	96.9	93.3	87.9	95.1
P2Y$_{12}$ receptor inhibitor	93.1	88.4	82.5	91.2	75.3	62.3	55.4	72.0
Beta-blocker	97.5	95.7	91.2	95.9	96.2	93.3	88.5	94.0
ACE inhibitor/ARB	75.1	69.9	63.2	73.5	66.4	62.9	56.8	62.6
Statin	97.7	94.8	88.8	96.3	95.1	89.8	83.7	92.6
Cardiac rehabilitation referral‡	85.6	79.4	75.8	78.1	75.6	61.7	50.2	71.9

Continuous variables are expressed as median (25th, 75th percentile) and categorical variables are expressed as percentages. ACE indicates angiotensin converting enzyme; ARB, angiotensin receptor blocker; CABG, coronary artery bypass grafting; ED, emergency department; NA, not applicable; NSTEMI, non–ST-segment–elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST-segment–elevation myocardial infarction.
*Among patients evaluated first in the emergency department.
†Excluding primary PCI treated and fibrinolysis ineligible patients.
‡Among patients discharged alive.

impairment and 75.8% of patients with STEMI with moderate/severe cognitive impairment were referred for cardiac rehabilitation (*P*<0.001) (Table 2).

Patients With NSTEMI

Among 90 904 NSTEMI patients with documented cognitive status, cognitive impairment was present in 8.3% (5.7% mild

cognitive impairment and 2.6% moderate/severe cognitive impairment). Compared with NSTEMI patients with normal cognitive function, NSTEMI patients with cognitive impairment were older, of lower body weight, with greater prevalence of prior heart failure, atrial fibrillation/flutter, and stroke, but similar rates of traditional atherothrombotic risk factors (Table 1). Similar to patients with STEMI, NSTEMI patients with cognitive impairment also had greater impairment in
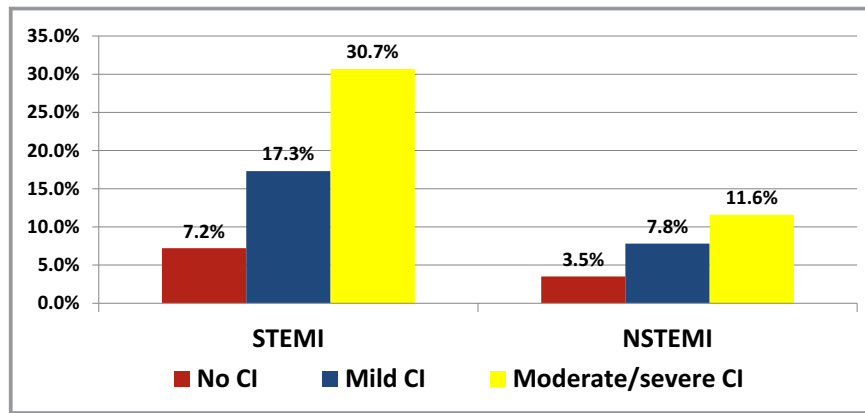
Figure. Unadjusted in-hospital mortality by presence and degree of cognitive impairment among patients with STEMI and NSTEMI, excluding transferred-out patients (n=7041). NSTEMI indicates non–ST-segment–elevation myocardial infarction; STEMI, ST-segment–elevation myocardial infarction.

mobility and greater requirement for assistance with activities of daily living, as well as greater heart failure and cardiogenic shock on presentation.

Compared with patients with normal cognitive function, use of cardiac medical therapy within 24 hours, as well as cardiac catheterization (no cognitive impairment, 84.7% versus mild cognitive impairment, 50.3% versus moderate/severe cognitive impairment, 24.6%; *P*<0.001) was significantly lower among patients with cognitive impairment, with lowest use among patients with moderate/severe cognitive impairment (Table 2). Both PCI and CABG were performed less frequently among patients with cognitive impairment, including those with mild cognitive impairment. At discharge, use of all cardiac medications was lower among patients with both mild and moderate/severe cognitive impairment.

Clinical outcomes

Compared with patients with NSTEMI with normal cognitive function, patients with NSTEMI with mild cognitive impairment had about 2-fold and patients with moderate/severe cognitive impairment had roughly a 3-fold higher rate of in-hospital mortality (Figure). After adjustment, cognitive impairment remained significantly associated with higher in-hospital mortality (mild: OR, 1.3, 95% CI, 1.2−1.5; moderate/severe: OR, 1.7, 95% CI, 1.4−2.0). Similar to patients with STEMI, referral for cardiac rehabilitation was significantly lower among patients with both mild and moderate/severe cognitive impairment (Table 2).

Discussion

In this large, contemporary cohort of older patients with MI in the United States, ≈1 in 13 have cognitive impairment documented in the medical record. Recognition of cognitive impairment is important, as it permits provision of early

counseling to patients and caregivers, enhanced communication about symptoms and treatment decisions, and identification of surrogate decision makers.[3] It also has implications for medication adherence, and patient safety. Despite the importance of early recognition of cognitive impairment and large prevalence among older patients, there remain substantial obstacles to its detection, including lack of physician time and ability to screen, particularly during MI hospitalization, as well as patient and physician discomfort with diagnosis and disclosure, and stigma about documentation. Although medical record documentation reflects recognition of advanced dementia, milder cognitive impairment is often underdocumented in medical charts even when physicians are aware of it. In one study, medical records documented 83% of patients with dementia, but only 26% of patients with cognitive impairment without dementia.[10] Therefore, it is likely that patients with true mild cognitive impairment might have been classified as having no cognitive impairment in our study, with implications for underestimating the true differences in use of evidence-based medical and invasive care as well as outcomes between patients with and without mild cognitive impairment.

We stratified our analysis by MI type because acute care and presentation for STEMI and NSTEMI differ. Unsurprisingly, patients with both STEMI and NSTEMI with documented cognitive impairment, even mild cognitive impairment, have greater medical comorbidities and greater impairment in mobility and greater requirement for assistance with activities of daily living. Use of ambulance transport and prehospital ECG was more frequent among patients with cognitive impairment. Despite a shorter duration of symptom onset to FMC, patients with STEMI with cognitive impairment had slightly longer duration from FMC to device time. This delay, albeit relatively small, in time to reperfusion after FMC in patients with cognitive impairment is potentially attributable

to greater time required for ascertainment of symptoms, often requiring corroboration from family members; establishing goals of care; and obtaining informed consent. Contrary to prior reports,[5,6] we found only marginal differences in rates of primary PCI between patients with STEMI with and without cognitive impairment. In a multicenter registry of older patients with acute MI from 2005 to 2008, Gharacholou et al[6] found that having cognitive impairment with no dementia was associated with 9.6% fewer cardiac catheterizations and 12.5% fewer PCIs compared with patients without cognitive impairment with no dementia. Similarly, Chanti-Ketterl et al[11] also found that among 8331 patients with STEMI for the years 2006–2007 registered in Florida's comprehensive inpatient surveillance system, even after adjustment for age, sex, and race/ethnicity, patients with dementia were 70% less likely to receive diagnostic cardiac catheterization than patients without dementia. With development of regional systems of care for STEMI over the past decade with preestablished rapid treatment protocols, patients with cognitive impairment and STEMI established before hospitalization brought to the catheterization laboratory are more likely now to receive primary PCI similar to patients with STEMI without cognitive impairment. However, our findings of lower rates of fibrinolysis among patients with STEMI with cognitive impairment are similar to previous findings in STEMI cohorts.[5] Treatment with fibrinolysis carries a risk of intracranial hemorrhage, which is likely greater among patients with cognitive impairment who are older and more likely to have greater absolute and relative contraindications for fibrinolysis such as prior intracranial hemorrhage, use of chronic anticoagulation, uncontrolled hypertension, and prior ischemic stroke. This explains, at least in part, the persistence in lower use of fibrinolysis in patients with STEMI with cognitive impairment despite the development of regional protocols for fibrinolysis at non-PCI hospitals.

The prevalence of cognitive impairment among patients with NSTEMI was greater than among patients with STEMI, who tended to be younger and affected by fewer comorbidities. Patients with NSTEMI with cognitive impairment continued to receive fewer cardiac medications within 24 hours, including antiplatelet medications, and rates of cardiac catheterization as well as revascularization with PCI and CABG were also substantially lower among patients with NSTEMI with cognitive impairment. One explanation for lower use of medical and invasive treatments for patients with cognitive impairment is that such people may be vulnerable to adverse effects of interventions or avoid them as based on individual preferences and goals for care.[5] Patients, families, and physicians must make assessments about future quantity and quality of life in making treatment decisions. We found that directives for comfort measures were greater even among those with mild cognitive impairment. Although do not

resuscitate is not the same as not requesting coronary angioplasty or cardiac bypass surgery, it might be an indicator of a desire not to pursue aggressive treatment. The finding that medical and invasive treatments were lower for patients requiring assistance with activities of daily living and ambulation, presumably with baseline lower quality of life, suggests some consideration of marginal benefit of care in making decisions.

In contrast to Gharacholou et al who found higher adjusted mortality among patients with moderate/severe cognitive impairment with no dementia but not mild cognitive impairment with no dementia at 1 year after acute MI,[6] we found 30% higher adjusted in-hospital mortality even among patients with STEMI with mild cognitive impairment I. This was observed despite similar use of primary PCI, although use of fibrinolysis was lower among patients with STEMI with mild cognitive impairment. Given that cognitive impairment was determined from chart documentation in this study, which is more likely to document more advanced cognitive impairment, it is possible that patients classified as having mild cognitive impairment in this study may in fact have more advanced cognitive impairment. Similar to patients with STEMI, compared with patients with NSTEMI without cognitive impairment, patients with NSTEMI with mild cognitive impairment had 30% higher adjusted in-hospital mortality. A graded relationship between severity of cognitive impairment and adjusted in-hospital mortality was observed among both patients with STEMI and NSTEMI. Our data are another example of the risk-treatment paradox observed previously in many MI cohorts,[12] where therapies remain paradoxically targeted toward lower-risk patients. Whether the provided in-hospital care was appropriate or whether outcomes would be improved with greater implementation of medical and invasive therapies among patients with cognitive impairment cannot be ascertained from these data. Inclusion of patients with cognitive impairment in future studies of cardiac therapies will inform how best to use such therapies in these patients. Furthermore, clinical guidelines and appropriate use criteria should reflect consideration of cognitive impairment in treatment decision making for older MI patients.

Rates of referral for cardiac rehabilitation at hospital discharge were lower among patients with cognitive impairment. Cardiac rehabilitation improves physical functioning and promotes positive behavioral and lifestyle changes.[13] Beyond improvements in physical function, exercise maybe beneficial from a cognitive perspective,[14] and there is evidence that cardiac rehabilitation may improve cardiac outcomes among patients with mild cognitive impairment.[15] Although patients with advanced cognitive impairment may have difficulty in participating in cardiac rehabilitation, patients with MI with mild cognitive impairment have the potential to derive benefit from cardiac rehabilitation. Given

the strong association between presence and severity of cognitive impairment with in-hospital mortality, it is vital for treating professionals to be adept at recognizing cognitive impairment and appropriately managing noncardiac in addition to cardiac conditions during and after hospitalization.

Limitations

Several limitations should be considered. First, classification of cognitive impairment was taken from chart review and not confirmed by formal testing. In addition, cognitive status was either missing or unknown in ≈7% of the study population. Consequently, the prevalence of cognitive impairment in this study is lower than noted in older adults in the general population.[2] Although recognition of more advanced cognitive impairment is less ambiguous, categorizing mild cognitive impairment can be more subjective and likely underestimated. Second, the effect of cognitive impairment on the occurrence of MI cannot be determined from this study. Third, the data source lacks precision on reasons (eg, physician and patient preference) for not using individual medications and procedures. Factors beyond those captured on the data collection form may represent unmeasured confounders that contributed to the discrepancy in therapies provided to patients with cognitive impairment, and future registries should collect data on reasons why certain therapies are not used in individual patients. Patients transferred out were excluded from the in-hospital mortality analysis, as outcomes after transfer out are not recorded. Thus, it is unknown whether in-hospital outcomes after transfer differ among patients with and without cognitive impairment, as is whether presence and degree of cognitive impairment is associated with the decision to transfer. Finally, causes of in-hospital death, as well outcomes after discharge, including mortality and quality of life, cannot be determined in this study.

Conclusion

Approximately 1 in 13 older patients with MI in the United States have cognitive impairment documented in medical charts. Patients with NSTEMI with cognitive impairment received less medical and invasive cardiac care during index hospitalization. Patients with STEMI with cognitive impairment received less fibrinolysis but similar primary PCI. After adjustment for patient risk factors associated with mortality after MI, presence and degree of cognitive impairment remains associated with increased in-hospital mortality. Improving outcomes of this patient population requires understanding the MI presentation in context of other medical conditions and patient goals of care. It also requires addressing noncardiac risk for mortality during and after

hospitalization. Additional studies are needed to determine an optimal approach to inform clinical decision making for older patients with MI with cognitive impairment.

Disclosures

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